DEALING WITH FEAR ITSELF, THE NUCLEAR CHALLENGE

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I. INTRODUCTION

The detonation of a stolen or improvised nuclear device by a terrorist organization within one of the world's cities would represent a challenge of enormous proportions to the modern civilized world. Other than the immediate consequences of human causalities and the loss of wealth and cultural symbols, the social convention and constraint that holds the international community together could be immediately compromised. Were such an event to occur within a modern democracy, the system of consensus freedoms and law that define such nations could be severely crippled in the panic to prevent any recurrent apocalyptic terrorist attacks. This most ominous of threats has risen to this level through a mosaic of diverse and complex reasons that have increased both the probability and consequences of such an event. Ironically, even the relaxation of the nuclear standoff between the United States and Russia, while a very positive development, has contributed to the emerging threat of nuclear terrorism. First, the quantities of nuclear weapons-capable materials residing outside martial control have increased significantly in direct proportion to the reduction in nuclear arsenals. Second, the end of the Cold War has fostered an abandonment of nuclear hardening philosophy that is leaving our military forces more vulnerable to nuclear effects and thus a more attractive target of nuclear terrorists and pariah states bent on developing nuclear weapons in defiance of international accords. North Korea and Iran fall within this latter category.

However, the nuclear threat must be evaluated on the basis of probability and likely consequences. Civilization does not have the option of accepting the often quoted "not a matter of if, but of when" position. This paper evaluates these contributing factors and the realities of possible alternate outcomes. It explores the role and limits of technologies in moving toward these outcomes.

II. FEARING FEAR ITSELF, THE BEGINNING OF THE NUCLEAR AGE

The Manhattan Project was established amid fears of many knowledgeable people that our way of life might not survive. In its 60-year history, the nuclear weapons program of the United Sates has been maintained because it has successfully welded science and technology to form weapons to neutralize those and equally stressing catastrophic fears. In the tradition of the university heritage[1] in which that program has evolved, every idea has been questioned and pressed to exhaustion. As a result our nuclear weapons have come to represent one of the greatest paradoxes in the history of humankind, weapons that are concurrently intrinsically destructive and intrinsically safe, weapons of war that are designed to maintain the peace. Now that these important and competing attributes must be maintained without actual testing, the university environment is increasingly important in maintaining the enduring stockpile.[2] Moreover, we have also used science and technology to hammer out plowshares to solve other intractable problems and fears to make the world a better and brighter place.

III. THE WORLD POST-COLD WAR, INTERESTING TIMES[3]

Once the euphoria over the end of the Cold War was over, the world had to face new realities. Those realties included the fact that a nuclear weapons superpower was in an economic meltdown. The system of balanced agendas that had been in place for decades was gone and regional tyrants that had been kept under a modicum of control in the old system began to act in irrational ways to establish regional hegemonies. Thus, the new age was more complex and unpredictable than the old bipolar world. Faced with these new realities, Los Alamos and other National Laboratories had to inventory their capabilities and redirect them as appropriate to address new threats and allay new fears.

There was much existing capability that could be mustered immediately. For example, we were able to combine the nondestructive assay (NDA) systems developed at Los Alamos and the physical security expertise of Sandia to help manage and secure the very large inventories of excess Special Nuclear Materials (SNM) extant within the Former Soviet Union. These materials were accumulating without the security that nominally had been associated with nuclear weapons. In other parts of the world, inventories of plutonium had already been accumulating from

the nuclear power industry in which plutonium is being pulled out of spent nuclear fuel to facilitate long-term storage and for conversion into mixed oxide fuels.

Within these new realities, we also were looking at the possibility of so-called "loose nukes." Whatever the old Soviet Union's proclivities were, the Soviets did know how to protect their nuclear weapons. They had a very active program that combined their extensive and intrusive police powers and a robust transportation infrastructure with a disciplined, well-compensated cadre of warrant officers dedicated to the security of their weapons. However, with the collapse of the Soviet Union, we were confronted with the possibility of nuclear weapons being sold or given to terrorists or proliferant states. This potential was particularly ominous in the early days of the collapse when the economic situation was so dire.

IV. COMMENTS ON TERRORISM – THE NEW FACE OF FEAR

On 11 September 2000, I was in Israel presenting a lecture on terrorism. Concluding the lecture, I said that, as the sole remaining super power, America would become the lightning rod for the animus of the world. My host, with an ashen look on his face, interrupted me, "The World Trade Center is on fire and one tower has already collapsed and the Pentagon is on fire." I drove back to my hotel and spent the next twenty-four hours glued to the television wondering when or if I would ever get home. Obviously, I did get back eventually but the America I came back to was not the America I had left. As I ran the gauntlet of airport security, I realized that we all had lost the presumption of innocence. At that moment, I sensed that terrorism had captured the agenda and was controlling the way we behaved as a nation. We were working feverishly to prevent heinous acts of terrorism that unfortunately had already occurred.

In the face of such new realities, we all could come up with an impromptu description of terrorism. However, defining terrorism is surprising difficult since the victors ultimately get the privilege of doing so. Our legal system defines "terrorism" as premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents, usually intended to influence an audience.[4] Within this definition, violence perpetrated by a sitting government against its people would not be terrorism. The same could be said for violence conducted by a national force against citizens of another country or against the forces of another country. Of course these two examples could constitute

murder, genocide or war crimes but, by the above definition, they would not constitute terrorism

As deep into written history as we can look, terrorism, within our working definition, has been part of the human experience. Biblical stories such as Samson's tying firebrands to the tails of foxes and sending them scampering through the grain fields of the Philistines might be an example of terrorism. However, exactly when terrorism became part of our collective heritage is uncertain. The motive for this strategy of violence can be ascertained. Terrorism originated when an individual or group of individuals had unrealized but passionately sought objectives that far exceeded their ability and potential to achieve them by accepted means of behavior. This origin leads to the view that terrorism is a strategy of the weak employing violence committed against noncombatants to influence others in order to achieve an otherwise unachievable result. One sage described, terrorism is the loud cry of the otherwise unheard. Therefore, dialogue is essential in rooting out those factors that encourage terrorism as a means for achieving change. However, terrorism can never be elevated above what it really is: the wanton murder of innocents by criminal sociopaths. Understanding the origins of terrorism and its true nature allows us to define its fundamental characteristics and vulnerabilities.

First, as indicated, terrorism is a strategy of frustration and weakness and not a strategy of the strong. One might think otherwise from listening to the evening news. The 911 attack is frequently compared to Pearl Harbor and sometimes Al Qaeda is seemingly portrayed as a threat comparable to the Third Reich. Obviously, both conclusions are wrong. Pearl Harbor was a surprise attack carried out with aircraft far superior to anything we had at the time representing a massive projection of military power, and executed with great precision and discipline. Over the next five years, we would expend thousands of lives and unimaginable treasure locked in mortal combat with the Imperial Japanese Armed Forces all across the Pacific. By comparison, a few terrorists armed with box cutters attacking innocent passengers who had been conditioned not to resist was a horrendous act of savagery, but it was no Pearl Harbor. As to placing Al Qaeda in the same threat league as the Third Reich, again we need a lesson in history. In spite of the international sanctions, the Third Reich enjoyed the second-largest industrial base on earth. In a number of technical disciplines such as rocketry, organic chemistry, physics, and metallurgy, it led the world. The technical capabilities of German

military equipment, particularly in armor, aircraft, and artillery, exceeded that of any potential challenger and has been widely copied ever since. The SCUDS and NO DONG missiles we face today are variants of the German Wasserfallen Antiaircraft Missile of the 1940s.

In the Wehrmacht, 10 million highly trained and motivated troops could be brought onto the field in mechanized and armored transports and provided air cover by the Luftwaffe. Another 13 million Heer reservists could be called upon as needed. By comparison, Al Qaeda is a weak, ineffective, gaggle of cowards, religious extremists, and malcontents. Nothing of a technical nature or strategy they have created is worth emulating. Even so, we still have to worry about Al Qaeda and other cabals of hate. Certainly, they might steal something that causes severe physical and psychological damage.

For example, terrorists might cultivate and deploy infectious pathogens such as smallpox. Obviously, such an attack could be counter productive because, once released, the disease very likely would decimate the very societies the terrorists inveigh to represent. The use of chemical weapons also would be destructive, as would the release of certain classes of industrial chemicals. However, the most destructive threat would arise if they acquire an improvised or stolen nuclear weapon. It is for that reason that, in the war against terrorism, we should use our recourses and efforts to focusing on and prevent such low probability but high consequence threat.

Second, controlling the agenda and shaping the response is the real strategy of terrorists. Since the terrorists lack the necessary strength to defeat their target in a classical military sense, they use violence to trigger a predictable response on the part of the target. If successful, the terrorist act will precipitate a response that in itself constitutes the real goal of terrorist. For example, the terrorists cannot bring down our airline industry per se. However, they can cause us to have anxiety against flying even though the chance of being seriously injured or killed in a commercial aviation accident is about 0.00003% and to initiate security provisions that together push the industry over the precipice into bankruptcy. Similarly, the terrorists cannot really destroy our society. However, they can prompt us to respond in a way that causes us to forego our First Amendment Rights and the openness and enjoyment of our life style as a cost of being secure. In that case, we have become the destroyer of our way of life and not the terrorist. Therefore, it is imperative that every action we take in response to terrorism be

evaluated to ensure that we are not moving in the very direction planned and anticipated by the terrorist. Technologies can play a significant role is helping achieve this imperative.

Third, compared to other dangers we face, terrorism is an abnormal and relatively rare occurrence. On 11 September 2000, nineteen terrorists hijacked four airplanes and flew two into the World Trade Center, one into the Pentagon, and one – because the brave passengers intervened – into a field in Pennsylvania. The horrendous death toll included 33 crewmembers, 214 passengers, 125 in the Pentagon, and over 2,000 dead and missing in New York. The loss was appalling. However, in that same year, 42,000 Americans died in traffic accidents and over 400,000 were injured. Fifteen thousand people were murdered in our streets and homes. In the anthrax letters of 2001, five people unfortunately died. In that year, 20,000 Americans died of influenza and 100,000 were hospitalized with serious complications. The point is that, while terrorism is a threat to be concerned about, we need to keep that threat in the proper perspective.

Fourth, terrorist cells are highly disciplined and rational. We often think of terrorist as mad suicidal bombers. At the point of the spear, that image is not that far off the mark. Terrorist organizations can always find dupes somewhere, get them pumped up on hashish or inflammatory rhetoric, promise them rewards in the life to come, and have them drive an explosive laden truck into a building thereby proving Darwin right. At the controlling levels within terrorist organizations, however, actions are rational and it is the desire of most senior people in terrorist organizations to die at an advanced age in their beds. It is for that reason that deterrence, with the backing of technologies that can predictably find and incapacitate the senior controllers, could be an effective tool in discouraging terrorism.

Finally, terrorists have no defense but simplicity, secrecy and stealth unless they are given sanctuary. Terrorists make their weapons out of materials that could be purchased in most hardware stores. Shrapnel is derived from nails and screws. Poisons are derived from materials we see everyday. Bomb cases are made from pipes. The 911 hijackers used box cutters. With help from state sponsors, they have been known to mold high explosive that they must get from others into common articles to avoid detection. William Reed used his shoe as a bomb and his shoelace as a fuse that fortunately did not light because, in his panicked state, he had soaked it with his urine confirming, possibly, that terrorism is not an act of bravery but of cowardice.

Because terrorist operations operate from weakness, secrecy and stealth are essential to their success. A 'found-out" terrorist is a dead or incarcerated terrorist. Of course, obtaining sanctuary is an absolute requirement if terrorists hope to survive, operate, and succeed. The Aum Shinrikyo enjoyed sanctuary in Japan by hiding within the Japanese laws that made religious organizations "off limits" to police surveillance. That organization used our lax immigration laws as a sanctuary to train pilots in South Carolina that would have dispersed anthrax and sarin nerve agent over Japanese cities. Al Qaeda used that same sanctuary and other flight schools to train the 911 hijackers who carried out the one-way missions planned in the Afghani sanctuary provided by the Taliban.

V. THE HEIGHTENED THREAT OF NUCLEAR TERROISM

For decades nuclear weaponry, knowledge, and materials resided in the vaults of a few nations that operated within the construct of accepted international norms. As the world situation has changed after the Cold War, we face the possibility that nuclear weaponry might migrate from that normalcy. Two factors are involved in heightening the nuclear threat.

First, the more radicalized terrorist organizations, in part because of their fundamental weakness, seem enamored with the use of nuclear weaponry as a means to initiate major changes in out culture. Interestingly, they seem to be somewhat conflicted in this pursuit. From their actions we know that they covet the freedom, affluence and things that our culture is capable of generating. However, from their writings and fatwa's, we know that they vehemently hate our culture particularly the dominance it generates on the world scene. This hatred is so intense now and likely to be more intense in days to come that they are intellectually committed to detonating an improvised nuclear device to destroy the core of one of our cities to kill thousands or tens of thousands of our citizens. According to their proclamations, they expect that the most significant casualty would likely be the legal foundations and societal trust that underpin our way of life. When one looks at terrorists, read what they write, and listen to what they are saying, there is no question that their war is directed against our American culture and the global culture that it has spawned. To repeat for emphasis, we are in a cultural war and there is just one weapon system that is able to cause and instant cultural change.

The question we have to ask is, if a nuclear event resulted in instant carnage involving tens of thousands of people and concurrently destroyed

infrastructures and the symbols of our nation, would our Constitution have the strength to survive? While I hope as long as I breathe that it would survive, I am not sure how to answer this question. Obviously, no group of terrorists armed with WMD or any other panoply of weaponry could destroy this Nation. It is too strong and expansive. The danger is that in responding, we may destroy our own selves by sacrificing our liberties and core freedoms on the altar of enhanced security. What we should all fear the most is this potential outcome.

Second, six decades of bombarding our citizens with alarmist propaganda on radiation have prepared the battlefield of fear thereby rendering us victims of nuclear blackmail even if the terrorists never acquire a nuclear weapon. This bombardment comes to us in spite of the fact that we human beings have evolved and thrive in a radiation rich environment. The core of our ecosystem is a nuclear fusion reactor that bathes the earth in warmth, light, and other radiation. The seas and soil that sustain our food supply contains thorium, uranium and their daughters plus life essential potassium with its K-40 component. The core of the earth is kept molten by radioactive processes. These natural radioactive sources interacting with our bodies do cause the production of free radicals that left unchecked could cause mutations possibly leading to carcinoma. Fortunately, the human immune system, in response to our environment, has developed highly effective processes, such as antioxidant production, for neutralizing these free radicals. As a result of these effective processes, only one free radical in 1000 actually reaches our DNA to cause damage. Of course, as Myron Pollycove[5] points out, our bodies endogenously create 200 million times more "free radicals" (disease-causing mutations) per day than does this natural background. Doctor Pollycove went on to observe that low doses of radiation actually result in a net increase in antioxidants compared to free radicals. However, limiting our exposure to ionizing radiation is desirable and no one I know is advocating that we bring the fluoroscope back to the shoe store so we can stand in line to x-ray our feet. Better ways exist for infusing our bodies with antioxidants.

Even so, through six decades of constant pseudoscience decrying any anthropogenic radiation in the environment, we have created the perfect stage for the nuclear terrorist who is always looking for ways to exploit the irrational fears of target populations. That stage is being enforced everyday as we hobble our population with a baseless fear against anything that causes a single tick on the Geiger counter. In other words,

the same anti-nuclear agenda that has hobbled the nuclear power industry and prevented the sterilization of food borne bacteria by low doses of pasteurizing radiation has created the ideal playground for the terrorist.

VI. THE ROLE AND LIMITS OF SCIENCE AND TECHOLOGY

Fundamentally, the war against terrorism is a war of ideas. Therefore, science and technology can and must play crucial roles in educating our citizens as to realities of the threats they face without the destructive hyperbole that often pervades any discussion of this class of threats. Science and technology can effectively deny terrorists the sanctuaries they need for directing, planning and training. The activities and communicative networks of terrorists can be detected thereby denying them secrecy and stealth that they use to compensate for their basic weakness and vulnerability. Science and technology can be crucial in denying the terrorists their major goal, controlling the response agendas. That is, responses to terrorism can and must be designed and executed to make us stronger and more efficient and our freedoms and liberties more robust and expressive. If properly applied and planned, science and technologies can help achieve security by avoiding unnecessary intrusion into civil liberties and privacy. We can have our economy, privacy and liberties and still be secure. As the following examples show, science and technologies, many now available or under development at Los Alamos, coupled with innovative policies and implementation can move us in the proper direction.

Science and technology applied as responsive actions to terrorism can be designed and implemented to conclude in more capable response infrastructures. For example, investments in our public health services aimed at dealing with acts of bioterrorism, if properly planned, can help ensure that more capacity will be available to deal with natural pandemics such as SARS, virulent influenza, or West Nile fever. We are developing systems, operating at the carbon-silicon interface, that combine the antigenic recognition capabilities of single cells with the information processing speed of modern electronic systems. These detectors will permit the rapid diagnosis of pathogens in the physician's office without having to wait the hours involved culturing the pathogens. While the detector might be deployed to protect against bioterrorism, they can also identify such naturally occurring pathogens such as the *hanta* virus. The hours saved in identifying this particular virus can be the difference between surviving the infection and dying from it.

Science and technology can be used to simulate complex situations permitting national policy makers and legislators to authorize improvements designed to protect critical infrastructures against cyberterrorists that concurrently provide a more capable and secure information architecture for businesses and private citizens. For example, Los Alamos and Sandia National Laboratory have partnered to establish the National Infrastructure and Simulation Center (NISAC) to provide improved technical planning and decision support for the analysis of critical infrastructures. Simulation approaches developed in the center will permit effective routing of first responders, efficient allocation of resources, and effective defense options and strategies. This approach, while focused on counterterrorism, can be used to identify vulnerabilities that could grow out of natural disasters as well. The net result can be more robust and effective national infrastructures.

However, before we go into more detail on what science and technology can contribute, we should note the limits on what they can contribute. For example, science and technology cannot deliver a solution proscribed by the laws of physics and chemistry. If we are required to assay a package passively for the presences of a radiological material, neutron and gamma rays will behave like neutrons and gamma rays and rates of radiological decay are fixed in nature. In addition, science and technology can present national policy makers with difficult choices. For example, detectors placed in the cargo compartment of a large airliner can, if enough integration time, locate and characterize special nuclear material hidden in luggage. Since the detectors probably would not be able to define the configuration of that material, the national policy maker would have to decide what actions should be taken in the face of valid but inconclusive information. The consequence of making the wrong decision can be enormous. Finally, no combination of science and technology can provide absolute assurance that some clever or lucky terrorist, willing to die for some perverted cause, will not succeed in carrying out a deadly attack against our citizens.

VII. CONCLUSIONS

The war against global terrorism requires that we take steps to control the response agenda. If we constantly allow the terrorists to control and determine our response we will be puppets dancing at the end of their string. We know, of course, that the challenge will increase in potential consequence before it wanes. In their attempts to ratchet up the level of violence, terrorists eventually will try to cross the nuclear threshold. In dark places around the world they are already planning and

trying to acquire the materials and technologies to reach that goal. We cannot let them succeed. Fortunately, we have an overwhelming edge in science and technology and we must fully engage that edge to eliminate both the scourge of terrorism and the cauldrons of hate that sustain it from the face of the earth. The task will not be easy or short in duration. It will demand the best in us a individuals and the best of us collectively as free and open societies. It will demand the preemptive and rapid engagement of science and technologies to ensure success. In this struggle we must not lose sight of the compass of freedom. We must be vigilant in ensuring that our responses always result in more robust, capable and better societies in which our freedoms flourish. In that way, we and not the terrorists will control the agenda.

REFERENCES

[1] A university… is a place where inquiry is pushed forward, and discoveries verified and perfected, and rashness rendered innocuous, and error exposed, by the collision of mind with mind, and knowledge with knowledge. John Henry Cardinal Newman, ***What is a University?*** From a series of lectures delivered by Cardinal Newman between 1852 and 1854.

[2] University of California employees designed all nuclear weapons tested and stockpiled by the United States since 1943. Los Alamos designed and therefore retains support responsibility for 75% of our enduring nuclear weapons stockpile.

[3] An old Chinese curse is, "May you live in interesting times."

[4] Title 22 of the United States Code, Section 265f(d). By comparison, UN Resolution Language GA Res 51/210/1999 defines terrorism as, "Criminal acts intended or calculated to provoke a state of terror in the general public, a group of persons or particular persons for political purposes are in any circumstance unjustifiable, whatever the considerations of a political, philosophical, ideological, racial, ethnic, religious or other nature that may be invoked to justify them."

[5] "Low-Level Radiation Health Effects" session during the American Nuclear Society Winter Meeting, November 14-18, 1999, Long Beach, Calif.